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CALIFORNIA ENERGY COMMISSION

BLUEPRINT

EFFICIENCY AND RENEWABLE ENERGY DIVISION

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Cool Roof Requirements Under the *2008 Building Energy Efficiency Standards*

WHAT ARE *COOL ROOFS*?

The term *cool roof* refers to a roofing product with high solar reflectance and thermal emittance properties. These properties help reduce cooling loads by lowering roof temperatures on hot, sunny days. There are numerous materials in a wide range of colors that meet cool roof requirements.

WHAT'S NEW IN THE *2008 STANDARDS* REGARDING COOL ROOFS?

Under the *2005 Building Energy Efficiency Standards* (*2005 Standards*), cool roofs were required only when using the prescriptive approach for low-sloped roofs in nonresidential buildings. Under the *2008 Standards*:

- Cool roofs are required when using the prescriptive approach for most low-sloped *and* steep-sloped roofs in residential *and* nonresidential buildings.
- Cool roof requirements vary by climate zone and roofing material weight.
- Solar reflectance values are now based on their reflectance properties after three years (known as "aged reflectance") as opposed to their initial values.
- A Solar Reflectance Index (SRI) has been developed to provide another means of demonstrating compliance.

Photo Credit: ASC Building Products

WHAT ARE *SOLAR REFLECTANCE* AND *THERMAL EMITTANCE*?

Solar reflectance refers to a material's ability to reflect the sun's energy back into the atmosphere, much like how light is reflected by a mirror. Even for materials with high solar reflectance, a portion of the sun's energy is absorbed and stored as heat. Once absorbed, some of this heat is rejected, or emitted, back into the air. *Thermal emittance* provides a means of quantifying how much of the absorbed heat is rejected for a given material. Materials with good solar reflectance and thermal emittance properties are critical in delivering the low surface temperatures associated with cool roofs.

WHAT IS THE SOLAR REFLECTANCE INDEX (SRI)?

The SRI provides an alternative to meeting solar reflectance and thermal emittance requirements for cool roofs. The SRI allows for tradeoffs between the minimum solar reflectance and thermal emittance values that would otherwise be used for compliance under the prescriptive approach. The SRI values range from 0 to 100, with a higher SRI being better.

WHO RATES COOL ROOF MATERIALS?

The Cool Roof Rating Council (CRRC) is the sole entity the California Energy Commission recognizes for certifying the solar reflectance and thermal emittance values of roofing products. Only reflectance and emittance values listed within the CRRC's Rated Products Directory, at www.coolroofs.org/products/search.php, may be used to meet cool roof requirements.

WHY DO THE *STANDARDS* CALL FOR AGED REFLECTANCE VALUES RATHER THAN INITIAL REFLECTANCE VALUES?

As a roofing material ages, its ability to reflect heat decreases. Using an aged reflectance value rather than an initial reflectance value more accurately represents how a roofing material will perform over time. If an aged reflectance value is not yet in the Rated Products Directory, the following equation may be used to calculate the aged Solar Reflectance, where $\rho_{initial}$ is the initial solar reflectance value found in the directory:

$$\text{Aged Reflectance}_{calculated} = (0.2 + 0.7[\rho_{initial} - 0.2])$$

ARE LIQUID-APPLIED ROOF COATINGS ALLOWED TO BE USED IN CALIFORNIA?

Absolutely. When used to take performance compliance credit or to meet prescriptive requirements for reflectance and emittance, liquid-applied roof coatings (like any other roofing products) must have a clearly visible packaging label that lists the solar emittance and the initial and three-year aged reflectance from the CRRC's Rated Products Directory.

Additionally, packaging for liquid-applied roof coatings must state that the product meets the ASTM requirements specified in Section 118(i) 4 of the *Standards*.

WHAT ARE THE MINIMUM REQUIREMENTS NEEDED TO DEMONSTRATE COMPLIANCE WITH THE PRESCRIPTIVE APPROACH?

The following tables show the minimum solar reflectance, thermal emittance, and SRI values needed to demonstrate compliance under the prescriptive approach. If a climate zone is not listed in the tables for a given building type and roof characteristic, cool roofs are not required for that climate zone, building type, and roof characteristic. These requirements apply only to *conditioned buildings*, buildings that are mechanically heated or cooled. A *low-sloped* roof has a rise to run ratio of 2:12 or less. A *steep-sloped* roof has a rise to run ratio greater than 2:12. Please refer to www.energy.ca.gov/maps/building_climate_zones.html or call the Energy Efficiency Hotline at (800) 772-3300 to find out what climate zone a proposed project is in.

Photo Credit: MonierLifetile

RESIDENTIAL BUILDINGS

Climate Zone	Roof Characteristic(s)	Aged Reflectance	Emittance	SRI
13 & 15	Low-sloped	0.55	0.75	64
10-15	Steep-sloped and roofing product density < 5 lb/ft^2	0.2	0.75	16
1-16	Steep-sloped and roofing product density ≥ 5 lb/ft^2	0.15	0.75	10

NONRESIDENTIAL BUILDINGS

Climate Zone	Roof Characteristic(s)	Aged Reflectance	Emittance	SRI
2-15	Low-sloped	0.55	0.75	64
2-16	Steep-sloped and roofing product density < 5 lb/ft^2	0.2	0.75	16
1-16	Steep-sloped and roofing product density ≥ 5 lb/ft^2	0.15	0.75	10

HIGH-RISE RESIDENTIAL BUILDINGS, HOTELS, AND MOTELS

Climate Zone	Roof Characteristic(s)	Aged Reflectance	Emittance	SRI
10, 11, 13-15	Low-sloped	0.55	0.75	64

RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE THE MANUFACTURER CERTIFIES USE IN ALL CLIMATE ZONES

Roof Characteristic(s)	Aged Reflectance	Emittance	SRI
Low-sloped	0.55	0.75	64
Steep-sloped and roofing product density < 5 lb/ft^2	0.2	0.75	16
Steep-sloped and roofing product density ≥ 5 lb/ft^2	0.12	0.75	10

ARE THERE ANY EXCEPTIONS TO THE ABOVE REQUIREMENTS?

- Cool roofs are not required for a roof area covered by building-integrated photovoltaic panels or building-integrated solar thermal panels.
- Cool roofs are not required for low-sloped roof constructions that have thermal mass over the roof membrane with a weight of at least 25 lb/ft^2. This includes green roofs (roofs that are covered with vegetation) weighing at least 25 lb/ft^2, though any portion of the roof not covered with vegetation will need to comply with cool roof requirements if not otherwise exempt.
- Cool roofs are not required for nonresidential wood-framed roofs in climate zones 3 and 5 if the roof assembly has a U-factor* of 0.039 or lower.
- Cool roofs are not required for nonresidential metal-framed roofs in climate zones 3 and 5 if the roof assembly has a U-factor of 0.048 or lower.

*In general terms, U-factor describes how readily a building material transmits heat; a lower U-factor indicates that a material is a better insulator.

- The following exceptions and alternatives to the prescriptive requirements apply to residential alterations:

SLOPE	COOL ROOFS ARE NOT REQUIRED IN THE FOLLOWING SITUATIONS
Low-Sloped	• Building has no ducts in the attic.
Steep-Sloped	• Insulation with a thermal resistance of at least 0.85 hr·ft^2·°F/Btu or at least a 3/4-inch air-space is added to the roof deck over an attic. • Existing ducts in the attic are insulated and sealed according to §151(f)10. • In climate zones 10, 12, and 13, with 1 ft^2 of free ventilation area of attic ventilation for every 150 ft^2 of attic floor area, and where at least 30 percent of the free ventilation area is within 2 feet vertical distance of the roof ridge. • Building has at least R-30 ceiling insulation. • Building has a radiant barrier in the attic meeting the requirements of §151(f)2. • Building has no ducts in the attic. • In climate zones 10, 11, 13, and 14, R-3 or greater roof deck insulation above vented attic.

WHAT ARE THE INSULATION REQUIREMENTS FOR ROOF ALTERATIONS?

If reroofing certain building types with low-sloped roofs that have less than R-7 insulation, new insulation must be installed that meets the requirements of the table below.

	Nonresidential Buildings		High-Rise Residential Buildings and Guest Rooms of Hotels and Motels	
Climate Zone	Continuous Insulation R-value	U-factor	Continuous Insulation R-value	U-factor
1, 3-9	R-8	0.081	R-14	0.055
2, 10-16	R-14	0.055	R-14	0.055

Photo Credit: MonierLifetile

HERS Verification Requirements for the Alternate Charge Measurement Procedure

For an air conditioner that is installed when the outdoor temperature is below 55°F, the installing contractor must use the Alternate Charge Measurement Procedure (Weigh-in Charging Method, Reference Residential Appendix RA3.2.3). Every system on which the Alternate Charge Measurement Procedure was used must be field verified by a Home Energy Rating System (HERS) rater, using the Standard Charge Measurement Procedure (Reference Residential Appendix RA3.2.2), when the outdoor temperature is above 55°F. Group sampling is not allowed for HERS verification compliance for systems when the installing contractor used the Alternate Charge Measurement Procedure.

Note that, according to Reference Residential Appendix RA2.4.4, an enforcement agency may approve compliance credit for refrigerant charge measurement when installers have used the Alternate Charge Measurement Procedure. This approval will be on the condition that the installer provides a signed agreement to the builder, with a copy to the enforcement agency, to correct the refrigerant charge if the HERS rater determines at a later time, when the outside temperature is above 55°F, that correction is necessary.

If the Alternate Charge Measurement Procedure was used, the installing contractor must complete and submit a CF-6R-MECH-26-HERS. If the Standard Charge Measurement Procedure was used, the installing contractor must complete and submit a CF-6R-MECH-25-HERS. When either charge measurement procedure was used by the installing contractor, the HERS rater must complete and submit a CF-4R-MECH-25.

CSLB Enforcement Efforts

Beginning in January 2010 the Contractors State License Board (CSLB) accelerated their enforcement efforts against contractors who are performing work without required building permits. CSLB notes that permit violations are not only a health and safety issue for property owners, but can also be a financial liability if someone is injured.

Contractors performing work without a required permit are subject to disciplinary action by CSLB. If you know of a contractor who is performing work without a required permit, you should notify CSLB and the local building department where the work is being performed. CSLB has developed a "Permit Violation Referral Form" to report offenders and on November 30, 2009, issued *Industry Bulletin # 09-19* to address this issue.

The California Energy Commission, CSLB, California Building Officials (CALBO), and your local building jurisdictions are working to help locate and identify suspected offenders. These agencies, with the assistance of the Attorney General's Office, are actively investigating complaints to increase compliance with the *Building Energy Efficiency Standards* and other codes, to level the playing field for the licensed contractors who pull permits and perform work as required by the codes, ordinances, and standards.

To obtain a copy of the "Permit Violation Referral Form" and review the CSLB *Industry Bulletin*, go to the following Energy Commission website:

www.energy.ca.gov/title24/2008standards/changeout/

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Building Energy Efficiency Standards Training

Please visit the Energy Commission's new **Energy Education Center** at:

www.energyvideos.com

For training offered by utilities and others, please visit the following websites:

PG&E
www.pge.com/mybusiness/edusafety/training/pec/classes/

SoCal Gas Company
http://seminars.socalgas.com

San Diego Gas and Electric
http://seminars.sdge.com

SCE
www.sce.com/b-sb/energy-centers/workshops-classes.htm

SMUD
www.smud.org/en/education-safety/

CALBO
www.calbo.org

CABEC
www.cabec.org

Flex your POWER

Flex Your Power News
www.fypower.org/news

GO solar CALIFORNIA

www.gosolarcalifornia.org

The *2008 Building Energy Efficiency Standards* are now in effect.

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Need Help?
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